PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-154652

(43)Date of publication of application : 27.05.2003

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(51)Int.Cl. B41J 2/045

B41J 2/01

B41J 2/055

B41J 2/16

G02B 5/20

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(54) INK JET HEAD AND ITS MANUFACTURING METHOD, INK JET RECORDER AND ITS MANUFACTURING METHOD, APPARATUS FOR MANUFACTURING COLOR FILTER AND MANUFACTURING METHOD THEREFOR, AND APPARATUS FOR MANUFACTURING ELECTROLUMINESCENCE SUBSTRATE AND MANUFACTURING METHOD THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an ink jet head which has the small number of parts, is simple in the structure and made small and light-weight.

SOLUTION: The ink jet head is provided with a plurality of nozzle holes 4, independent discharge chambers communicating with each of nozzle holes 4, and energy generating elements for applying a discharge energy to ink within discharge chambers. There are provided a line-shaped nozzle plate 3 having a

plurality of nozzle holes 4 formed thereto, and a plurality of chips 100 having discharge chambers and energy generating elements formed thereto. The plurality of chips 100 are set into a line to the nozzle plate 3.

CLAIMS

[Claim(s)]

[Claim 1]Two or more nozzle holes.

An energy generation element which gives regurgitation energy to an independent regurgitation room which is open for free passage to each of this nozzle hole, and ink of this regurgitation interior of a room.

A nozzle plate of line form in which it is the ink jet head provided with the above, and said two or more nozzle holes were formed, It has two or more chips with which said regurgitation room and said energy generation element were formed, and a chip of this plurality is installed in said nozzle plate at line form, and it is constituted.

[Claim 2]The ink jet head according to claim 1 forming said nozzle plate by a silicon substrate.

[Claim 3]The ink jet head according to claim 1 forming said nozzle plate with a stainless steel board.

[Claim 4]Two or more nozzle holes.

An energy generation element which gives regurgitation energy to an independent regurgitation room which is open for free passage to each of this nozzle hole, and ink of this regurgitation interior of a room.

Two or more chips with which it is the ink jet head provided with the above, and said two or more nozzle holes and said regurgitation room were formed, It has a substrate of line form with which an energy generation element which gives regurgitation energy to said ink of the regurgitation interior of a room was formed, and said two or more chips are installed in said substrate at line form, and it is constituted.

[Claim 5]The ink jet head according to any one of claims 1 to 4, wherein said energy generation element is a pressure generating element which gives pressure variation which makes an ink droplet fly to said regurgitation room.

[Claim 6]The ink jet head comprising according to claim 5:

A diaphragm by which a pressure generating element was formed in at least one wall of a regurgitation room.

An electrode made to change this diaphragm according to electrostatic force by impression of driver voltage.

[Claim 7]The ink jet head according to any one of claims 1 to 6 being a face type ink jet head which makes an ink drop breathe out from a surface part of a substrate.

[Claim 8]The ink jet head according to claim 7, wherein a nozzle plate is provided with an ink reservoir.

[Claim 9]The ink jet head according to any one of claims 1 to 6 being an edge type ink jet head which makes an ink drop breathe out from an end of a substrate.

[Claim 10]A manufacturing method of an ink jet head provided with two or more nozzle holes and an independent regurgitation room which is open for free passage to each of this nozzle hole characterized by comprising the following,

and an energy generation element which gives regurgitation energy to ink of this regurgitation interior of a room.

A process of forming a nozzle plate of line form in which said two or more nozzle holes were formed.

A process of forming two or more chips with which said regurgitation room and said energy generation element were formed.

A process of installing a chip of this plurality in said nozzle plate at line form.

[Claim 11]A manufacturing method of the ink jet head according to claim 10 using a silicon substrate for said nozzle plate, and forming said two or more nozzle holes in this silicon substrate by photolitho processing.

[Claim 12]A manufacturing method of an ink jet head provided with two or more nozzle holes and an independent regurgitation room which is open for free passage to each of this nozzle hole characterized by comprising the following, and an energy generation element which gives regurgitation energy to ink of this regurgitation interior of a room.

A process of forming two or more chips with which said two or more nozzle holes and said regurgitation room were formed.

A process of forming a substrate of line form with which an energy generation element which gives regurgitation energy to said ink of the regurgitation interior

of a room was formed.

A process of installing said two or more chips in said substrate at line form.

[Claim 13]A manufacturing method of the ink jet head according to claim 12 using a glass substrate for said substrate and forming said energy generation element formation part in this glass substrate by photolitho processing.

[Claim 14]An ink-jet recording device carrying the ink jet head according to any one of claims 1 to 9.

[Claim 15]A manufacturing method of an ink-jet recording device manufacturing an ink jet head with the ink jet head manufacturing method according to any one of claims 10 to 13, and carrying the ink jet head concerned.

[Claim 16]A manufacturing installation of a light filter, wherein the ink jet head according to any one of claims 1 to 9 is carried.

[Claim 17]A manufacturing method of a manufacturing installation of a light filter having manufactured an ink jet head with a manufacturing method of the ink jet head according to any one of claims 10 to 13, and carrying the ink jet head.

[Claim 18]An electroluminescence board manufacturing installation, wherein the ink jet head according to any one of claims 1 to 9 is carried.

[Claim 19]A manufacturing method of an electroluminescence board manufacturing installation having manufactured an ink jet head with a

manufacturing method of the ink jet head according to any one of claims 10 to 13, and carrying the ink jet head.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to a manufacturing installation of an ink jet head provided with two or more nozzles in the direction of a print line, a manufacturing method for the same, an ink-jet recording device and a manufacturing method for the same, and a light filter, a manufacturing method for the same, an electroluminescence board manufacturing installation, and a manufacturing method for the same.

[0002]

[Description of the Prior Art]In recent years, a recorder has come to be asked for high speed printing. However, in the method which scans a head in the conventional direction of a print line, since the mass of a head also increased when there are many recording elements, the load of the head scanner also became large and there was a limit in increasing the number of recording

elements. Then, what is called a line type which puts many recording elements in order at the same interval as the resolution of printing in the direction of a print line, and is printed with the fixed head of ink jet head is devised.

[0003]As an example of a such line type ink jet, there is an ink jet recording head indicated by JP,11-20168,A, for example. The ink jet head of the gazette is joined on the element substrate by which the fluting member in which the slot which constitutes a delivery and an ink passage was formed was provided in the energy generation element. And an element substrate is not manufactured as one, but two or more small element substrates are formed, and he arranges two or more of these element substrates in on a base, and is trying to fix from a viewpoint of the yield of an element substrate.

[0004]When two or more element substrates are put in order and it fixes, it will be difficult to stick a ****** element substrate certainly and to fix, and a crevice will arise between element substrates. Therefore, in the boundary part of an element substrate, if a fluting member is not joined so that the wall between the slots of a member with a slot may straddle two element substrates, ink leakage will arise from between element substrates. So, in the gazette, while arranging so that the wall between the slots of a member with a slot may straddle the element substrate of two ******, in order to lessen the adverse effect of this crevice as much as possible, the groove face corresponding to said crevice is

set up for a long time than other groove faces.

[0005]

[Problem(s) to be Solved by the Invention]However, in the above-mentioned conventional ink jet head, the base for putting in order and assembling these other than the nozzle actuator which constitutes an ink jet head is needed. For this reason, part mark increase, structure is complicated and there is a problem that a head becomes heavy.

[0006]Since it is necessary to arrange so that the wall between the slots of a member with a slot may straddle the element substrate of two ******, the accuracy at the time of an assembly is required and there is a problem that an assembly is difficult.

[0007]It is made in order that this invention may solve this problem, and there are few part mark, structure is simple, and it aims at providing the ink jet head which can do the miniaturization of a head, and a weight saving. It aims at providing the manufacturing method of this ink jet head. It aims at obtaining a manufacturing installation of a recorder using this ink jet head and a manufacturing method for the same, and a light filter, a manufacturing method for the same, an electroluminescence board manufacturing installation, and a manufacturing method for the same.

[0008]

[Means for Solving the Problem](1) An ink jet head concerning one mode of this invention, In a thing provided with two or more nozzle holes, an independent regurgitation room which is open for free passage to each of this nozzle hole, and an energy generation element which gives regurgitation energy to ink of this regurgitation interior of a room, It has a nozzle plate of line form in which said two or more nozzle holes were formed, and two or more chips with which said regurgitation room and said energy generation element were formed, and a chip of this plurality is installed in said nozzle plate at line form, and it is constituted. In this invention, a nozzle plate of line form is the component part of an actuator of an ink jet head, and it has a function of a substrate as a structure. Therefore, a substrate as a structure is not needed separately. As an example of an energy generation element, a heater board etc. which heat ink of the regurgitation interior of a room are included besides the below-mentioned pressure generating element.

[0009](2) An ink jet head concerning other modes of this invention forms a nozzle plate by a silicon substrate in an ink jet head of the above (1). In this invention, by forming a nozzle plate by a silicon substrate, a nozzle hole is put in block according to a photolithography process, and can be formed, and accuracy of position of a nozzle hole can be made very high.

[0010](3) An ink jet head concerning other modes of this invention forms a

nozzle plate with a stainless steel board in an ink jet head of the above (1).

[0011](4) An ink jet head concerning other modes of this invention, In a thing provided with two or more nozzle holes, an independent regurgitation room which is open for free passage to each of this nozzle hole, and an energy generation element which gives regurgitation energy to ink of this regurgitation interior of a room, It has two or more chips with which said two or more nozzle holes and said regurgitation room were formed, and a substrate of line form with which an energy generation element which gives regurgitation energy to said ink of the regurgitation interior of a room was formed, and said two or more chips are installed in said substrate at line form, and it is constituted. In this invention, a substrate of line form is the component part of an actuator of an ink jet head, and it has a function of a substrate as a structure. Therefore, a substrate as a structure is not needed separately.

[0012](5) Let an ink jet head concerning other modes of this invention be a pressure generating element which gives pressure variation which makes an ink droplet an energy generation element fly in a regurgitation room in the above (1) thru/or an ink jet head of (4). As an example of a pressure generating element, a thing using a piezoelectric element besides a thing using the below-mentioned electrostatic force is also included.

[0013](6) An ink jet head concerning other modes of this invention, In an ink jet

head of the above (5), it has composition provided with an electrode made to change this diaphragm according to electrostatic force by a diaphragm formed in at least one wall of a regurgitation room in a pressure generating element, and impression of driver voltage.

[0014](7) An ink jet head concerning other modes of this invention is characterized by being a face type ink jet head which makes an ink drop breathe out from a surface part of a substrate in the above (1) thru/or an ink jet head of (6).

[0015](8) As for an ink jet head concerning other modes of this invention, a nozzle plate is provided with an ink reservoir in an ink jet head of the above (7).

[0016](9) An ink jet head concerning other modes of this invention is characterized by being an edge type ink jet head which makes an ink drop breathe out from an end of a substrate in the above (1) thru/or an ink jet head of (6).

[0017](10) A manufacturing method of an ink jet head concerning one mode of this invention, It is characterized by comprising the following in a manufacturing method of an ink jet head provided with two or more nozzle holes, an independent regurgitation room which is open for free passage to each of this nozzle hole, and an energy generation element which gives regurgitation energy to ink of this regurgitation interior of a room:

A process of forming a nozzle plate of line form in which said two or more nozzle holes were formed.

A process of forming two or more chips with which said regurgitation room and said energy generation element were formed.

A process of installing a chip of this plurality in said nozzle plate at line form.

[0018](11) A manufacturing method of an ink jet head concerning other modes of this invention, In a manufacturing method of an ink jet head of the above (10), a silicon substrate is used for said nozzle plate, and said two or more nozzle holes are formed in this silicon substrate by photolitho processing. In this invention, a nozzle hole is put in block to a silicon substrate by photolitho processing, and can be formed, and accuracy of position of a nozzle hole can be made very high.

[0019](12) A manufacturing method of an ink jet head concerning other modes of this invention, It is characterized by comprising the following in a manufacturing method of an ink jet head provided with two or more nozzle holes, an independent regurgitation room which is open for free passage to each of this nozzle hole, and an energy generation element which gives regurgitation energy to ink of this regurgitation interior of a room:

A process of forming two or more chips with which said two or more nozzle holes and said regurgitation room were formed.

A process of forming a substrate of line form with which an energy generation element which gives regurgitation energy to said ink of the regurgitation interior of a room was formed.

A process of installing said two or more chips in said substrate at line form.

[0020](13) A manufacturing method of an ink jet head concerning other modes of this invention, In a manufacturing method of an ink jet head of the above (12), a glass substrate is used for said substrate and said energy generation element formation part is formed in this glass substrate by photolitho processing.

[0021](14) An ink-jet recording device concerning one mode of this invention carries the above (1) thru/or which ink jet head of (9). In this invention, since printing is possible in operation of only sending a recording form, without moving an ink jet head in the record paper width direction, press speed can be raised extremely.

[0022](15) A manufacturing method of an ink-jet recording device concerning one mode of this invention manufactures an ink jet head with the above (10) thru/or which ink jet head manufacturing method of (13), and make it carry the ink jet head concerned.

[0023](16) A manufacturing installation of a light filter concerning one mode of this invention carries the above (1) thru/or which ink jet head of (9).

[0024](17) A manufacturing method of a manufacturing installation of a light filter concerning one mode of this invention manufactures an ink jet head with a manufacturing method of the above (10) thru/or which ink jet head of (13), and carries the ink jet head.

[0025](18) An electroluminescence board manufacturing installation concerning one mode of this invention carries the above (1) thru/or which ink jet head of (9).

[0026](19) A manufacturing method of an electroluminescence board manufacturing installation concerning one mode of this invention manufactures an ink jet head with a manufacturing method of the above (10) thru/or which ink jet head of (13), and carries the ink jet head.

[0027]

[Embodiment of the Invention]Embodiment 1.

(composition) Drawing 1 is an explanatory view of the entire configuration of the embodiment of the invention 1. As this embodiment is related with the ink jet head of an electrostatic drive system and it is shown in drawing 1, The head chip 100 which consists of the 1st substrate 1 that constitutes an ink jet actuator, and the 2nd substrate is arranged in line form, and it joins to the 3rd single substrate (nozzle plate) with which the nozzle hole 4 was formed.

[0028]It is more specifically 360dpi (dot per inch) which is the standard resolution of a business-use printer, 1536 nozzles and a 4.3-inch line head unit are

constituted by putting in order in parallel the six head chips 100 which have 256 projection rooms per one chip. This line ink jet head is carried in the line printer for for example, ticket printing.

[0029]Wiring mounting of each head chip 100 is carried out by FPC(Flexible Printed Circuit board) 103 which has the driver 102 for a drive.

[0030]Drawing 2 is an exploded perspective view showing some line head units of this Embodiment 1 in a section. This embodiment gives and explains the example of the face ink jet type which makes an ink drop breathe out from the nozzle hole established in the surface part of the substrate. The section side view of the whole device with which drawing 3 was assembled, and drawing 4 are the A-A line view figures of drawing 3.

[0031]The ink jet head of this embodiment comprises that three substrates of the 3rd long substrate with which the nozzle hole joined to the 1st substrate [with which the ink passage was formed], 2nd substrate [with which the electrode joined to this 1st board bottom was formed], and 1st substrate upper part was formed are joined. Hereafter, the composition of each substrate is explained.

[0032]The 1st substrate 1 consists of a silicon substrate of crystal face orientation (110), and to this silicon substrate. It has the crevice 12 which will constitute the regurgitation room 6 which uses a bottom wall as the diaphragm 5, and the crevice 14 which will constitute the common ink reservoir 8 for being

provided in the rear of the crevice 12 and supplying ink to the striation 13 and each regurgitation room 6 for ink flow ON.

[0033]The 2nd substrate 2 joined to the undersurface of the 1st substrate 1 consists of Pyrex (registered trademark) glass, and the crevice 25 for equipping with the electrode 21 is formed. By having formed this crevice 25, when the 1st substrate is joined, the gap G (refer to drawing 3) will be formed between the diaphragms 5. The inside of this crevice 25 is equipped with the electrode 21, the lead part 22, and the terminal area 23.

[0034]The electrode 21 carries out the 0.1-micrometer weld slag of the ITO into the crevice 25, and produces it by forming an ITO pattern, and is carrying out the weld slag of the gold for bonding only to the terminal area 23.

[0035]The silicon substrate was used, and the 3rd long substrate 3 joined to the upper surface of the 1st substrate 1 has established the nozzle hole 4 in the surface part of the 3rd substrate 3, respectively so that it may be open for free passage with each crevice 12 of the 1st substrate 1.

[0036]Next, the outline of operation of the ink jet head constituted as mentioned above is explained (refer to drawing 3). If pulse voltage is impressed to the electrode 21 by the drive circuit 102, for example, the surface of the electrode 21 is charged in plus, the undersurface of the corresponding diaphragm 5 will be charged in negative potential. Therefore, the diaphragm 5 bends in the electrode

21 side by the suction effect of static electricity.

[0037]Next, the diaphragm 5 will be restored if the electrode 21 is turned OFF. For this reason, it goes up rapidly, and from the nozzle hole 4, the pressure in the regurgitation room 6 turns the ink droplet 104 to the recording form 105, and carries out the regurgitation. Next, when the diaphragm 5 bends below again, the ink 106 is supplied in the regurgitation room 6 through the striation 13 from the ink reservoir 8. Thus, the diaphragm 5 and the electrode 21 function as pressure generating elements which give the pressure variation which makes an ink droplet fly to the regurgitation room 6, and are functioning as energy generation elements which give regurgitation energy more to the ink of the regurgitation interior of a room in generic concept.

[0038]In the ink jet head constituted as mentioned above, since the 3rd substrate 3 is making the substrate as a structure serve a double purpose, the substrate as a structure is not independently needed. Therefore, it is few, in structure, part mark become very simple, and the miniaturization and the weight saving are realized.

[0039](manufacturing method) Next, the manufacturing method of the ink jet head constituted as mentioned above is explained. Since an ink jet head is manufactured by joining three substrates which constitute this as mentioned above, it explains the manufacturing method of each substrate first.

[0040]Drawing 5 is an explanatory view of the manufacturing method of the 1st substrate 1. Form the oxidizing film 33 in the substrate 31 which consists of a plane direction (110) and a 140-micrometer-thick single crystal silicon wafer by wet oxidation (drawing 5 (a)), and substrate both sides by photo lithography. The oxidizing film 33 is etched in fluoric acid solution, and each shape of the regurgitation room 6, the ink reservoir 8, and the striation 13 is patterned. (Drawing 5 (b)).

[0041]If this substrate 31 is etched with 80 ** and 35% of potassium hydroxide solution, a partition part will be vertically etched by the anisotropy to etching of a silicon single crystal, and the regurgitation room 6, the ink reservoir 8, and the striation 13 will be formed of it. (Drawing 5 (c)).

[0042]The whole is formed by a thickness of 0.1 micrometer after the end of etching, and the oxidizing film 33 is formed by dry oxidation. Since the oxidizing film 33 formed in the passage face is hydrophilic nature, it serves to improve the restoration nature to the channel of ink. (Drawing 5 (d)).

[0043]Next, the process of the 2nd substrate 2 is explained based on drawing 6. Chromium and gold are formed on the glass substrate 35 by weld slag, and it is considered as an etching mask. And the crevice 25 which etches by fluoric acid and turns into a gap part is formed (drawing 6 (a)). Next, in the crevice 25, the 0.1-micrometer weld slag of the ITO is carried out, the electrode 21 is formed by

forming an ITO pattern, and the weld slag of the gold for bonding is further carried out only to the terminal area 23 (drawing 6 (b)).

[0044]Finally the process of the 3rd substrate is explained based on drawing 7. The oxidizing film 39 is formed in the substrate 37 which consists of single crystal silicon wafers by wet oxidation (drawing 7 (a)), the oxidizing film 39 is etched for substrate both sides in fluoric acid solution by photo lithography, and the discharge opening 4 and the ink feed opening 27 are patterned (drawing 7 (b)).

[0045]The discharge opening 4 is formed by carrying out anisotropic dry etching of this substrate. (Drawing 7 (c)). After the discharge opening 4 is formed, dicing is carried out to linesize.

[0046]Next, the assembly method of a line head unit is explained based on drawing 8. Anode joining is carried out by heating the 1st substrate 1 and the 2nd substrate 2 at 380 **, connecting silicon (the 1st substrate 1) to the anode, connecting a glass substrate (the 2nd substrate 2) to the negative pole, and adding the electrode of 800V (drawing 8 (a)).

[0047]About the good head chip 100 which joined the 1st substrate 1 and the 2nd substrate 2, it is ****** to the average on the 3rd substrate of line shape. It positions at this time, performing optical measurement. If this positioning is arranged so that each nozzle hole 4 of the 3rd substrate 3 may be open for free

passage in each regurgitation room 6, faults at least, such as ink leakage, will not be produced. That is, delicate positioning of arranging so that the wall between the slots of a member with a slot as shown by the conventional example may straddle the element substrate of two ****** is unnecessary. An end of positioning of all the head chips 100 will join the 3rd substrate 3 to the head chip 100 (drawing 8 (b)).

[0048]After assembling an ink jet head as mentioned above, the drive circuit 102 is connected with the wiring 101 between the terminal areas 23 of the 1st substrate 1 and the 2nd substrate 2, respectively, and the below-mentioned ink-jet recording device (or a manufacturing installation of a light filter, an electroluminescence board manufacturing installation) is constituted.

[0049]As mentioned above, according to this embodiment, the arrangement relationship of each head chip 100 and the 3rd substrate 3 (nozzle plate) does not need delicate positioning like before, but manufacture becomes easy. Since the 3rd substrate 3 is constituted from a long single board, and the nozzle hole 4 is put in block according to a photolithography process and formed, the accuracy of position of the nozzle hole 4 is very high, an error is about several microns, and there is almost no gap of the pitch between each nozzle hole.

[0050]Embodiment 2.

(composition) Drawing 9 is an explanatory view of the entire configuration of the

line head unit of the electrostatic drive system which is Embodiment 2, and gives the same numerals to the portion which is the same as that of drawing 1 in which Embodiment 1 was shown - drawing 8, or corresponds. in this embodiment -- edge type ink jet head **** -- the nozzle plate 41 of line form is used as a substrate as a structure. That is, a line head unit consists of making the nozzle plate 41 of line form arrange in parallel the head chip 100 which consists of the three substrates 1, 2, and 3, and joining.

[0051]Drawing 10 is an exploded perspective view of head chip 100 simple substance, and drawing 11 is the structure of an electrostatic drive system ink jet head, and an explanatory view of a driving principle. At this embodiment, like Embodiment 1 by 360dpi (dot per inch) which is the standard resolution of a business-use printer. 1536 nozzles and a 4.3-inch line head unit are constituted by putting in order in parallel the six head chips 100 which have 256 nozzles per one head.

[0052]The passage substrate 1 (equivalent to the 1st substrate 1 of Embodiment 1) which consists of silicon single crystals as each head chip 100 is shown in drawing 10 and drawing 11, They are the electrode glass substrate 2 (equivalent to the 2nd substrate 2 of Embodiment 1) which comprises borosilicate glass, and the structure which laminated the cover glass 3 (equivalent to the 3rd substrate 3 of Embodiment 1). The regurgitation room 6, the diaphragm 5, and the ink

reservoir 8 are formed in the passage substrate 1, and each regurgitation room 6 is separated by the septum 42. And a channel is formed by plugging up the passage substrate 1 upper surface with the cover glass 3 with which the nozzle 44 and the orifice 46 were formed.

[0053]The gap G and the individual electrode 21 are formed in the electrode glass substrate 2, and the seal 43 for preventing a foreign matter from invading into the gap G is given. The ink feed hole 27 is established in the position which avoids the individual electrode 21, and the ink 106 is supplied to the ink ink reservoir 8 from this ink feed hole 27.

[0054]The line head unit comprises that two or more head chips 100 constituted as mentioned above are joined to the nozzle plate 41 which was put in order by line form and served as the substrate as a structure as shown in drawing 9.

[0055]Operation of the line head unit constituted as mentioned above is explained. At the time of a drive, voltage is impressed to the common electrode 45 and the individual electrode 21 which were provided in the passage substrate 1, electrostatic attraction is generated between the diaphragm 5 and the individual electrode 21, and the ink 106 is filled up into the regurgitation room 6 with drawing the diaphragm 5 near to the individual electrode 21 from the ink ink reservoir 8 (drawing 11 (b)). Voltage is removed at the time of the regurgitation and the regurgitation of the ink 106 is carried out from the nozzle hole 4 via the

nozzle 44 according to the spring force of the diaphragm 5 (drawing 11 (c)).

[0056](manufacturing method) Drawing 12 - drawing 16 are the explanatory views of the manufacturing process of each head chip 100. First, the manufacturing method of the passage substrate 1 along which ink passes is explained based on drawing 12. After carrying out high concentration (about more than $5x10^{19}cm^{-3}$) diffusion of the boron in a depth of 0.8 micrometer and forming the boron layer 49 in the undersurface of the substrate 47 which consists of a plane direction (110) and a 140-micrometer-thick single crystal silicon wafer (drawing 12 (a)), The oxidizing film 51 is formed by wet oxidation, the oxidizing film 51 is etched for substrate both sides in fluoric acid solution by photo lithography, and regurgitation room shape, reservoir shape, and ink feed hole shape are patterned. (Drawing 12 (b)).

[0057]If this substrate 47 is etched with 80 ** and 35% of potassium hydroxide solution, a partition part will be vertically etched by the anisotropy to etching of a silicon single crystal, the regurgitation room 6 will be formed of it, and the ink reservoir 8 will also be simultaneously formed of it. If an etching surface reaches the high-concentration boron layer 49, the solubility over a potassium hydroxide solution will change, an etch rate will fall, and the diaphragm 5 of uniform thickness will be formed. Since the boron layer 49 of the portion of the ink feed hole 27 is etched from the time of etching, it is penetrated to the ink reservoir 8

(drawing 12 (c)).

[0058]An insulator layer is formed in the diaphragm undersurface by forming the whole by a thickness of 0.1 micrometer after the end of etching, and forming the oxidizing film 51 by dry oxidation. Since the oxide film formed in the passage face is hydrophilic nature, it serves to improve the restoration nature to the channel of ink. Some oxidizing films 51 are removed by dry etching after oxidizing film 51 formation, and the common electrode 45 is formed by carrying out the weld slag of the platinum (drawing 12 (d)).

[0059]Next, the process of the electrode glass substrate 2 is explained based on drawing 13. Chromium and gold are formed on a borosilicate glass substrate by SUPAKKU, and it is considered as an etching mask. The level difference 25 which etches a borosilicate glass substrate by fluoric acid in a depth of 3000 A, and serves as a gap part is formed (drawing 13 (a)). After carrying out the weld slag of the ITO film which is a transparent electrode by a thickness of 0.1 micrometer, it patterns after the shape of the individual electrode 21. The opening of the ink feed hole 27 is carried out with a diamond drill after patterning (drawing 13 (b)).

[0060]Next, the process of the cover glass 3 is explained based on drawing 14. After forming chromium and gold by weld slag to the cover glass 3 and the borosilicate glass substrate which changes and patterning the pattern of the

nozzle 44 and the orifice 46, anisotropic dry etching is performed vertically and the nozzle 44 and the orifice 46 are formed in a depth of 20 micrometers.

[0061]The manufacturing method of the nozzle plate 41 is the same as that of Embodiment 1.

[0062]If four substrates which constitute a line head as mentioned above are formed, these will be joined and a line head will be formed. First, anode joining of the three substrates 1, 2, and 3 is laminated and carried out, and the head chip 100 is formed by cutting a zygote by dicing.

[0063]If the head chip 100 is formed, this will be arranged to line form, it will join to the nozzle plate 41, and a line head will be formed. As shown in drawing 15 at this time, since it is set up more greatly than the nozzle hole 4 of the nozzle plate 41, the opening of the nozzle 44 at the time of arrangement with the nozzle plate 41 and the head chip 100. The nozzle hole 4 of the nozzle plate 41 should just be settled in the opening of the nozzle 44, and does not need to perform advanced alignment.

[0064]Finally, as shown in drawing 16, the mount 53 for ink supply which has the ink feed path 52 is joined. On the mount 53 made from stainless steel, the line head 110 is arranged, and in order to fix this to the mount 53 and to carry out the seal of the circumference of the ink feed hole 27, it is filled up with the sealant of a silicone series through the seal hole 55 in the seal groove 57 from the mount

53 bottom. The sealant of a silicone series is used here in order to prevent the crack generation of the head chip 100 by the heat stress etc. which are generated between the mount 53 made from stainless steel, and the glass head chips 100. FPC mounting is performed after immobilization of the line head unit 110 is completed.

[0065]In the above-mentioned Embodiments 1 and 2, although the example using a silicon substrate as a nozzle plate was shown, this invention may not be restricted to this and may be a stainless steel board, for example.

[0066]Embodiment 3. drawing 17 is an explanatory view of the entire configuration of the line head unit of the electrostatic drive system which is the embodiment of the invention 3, and gives the same numerals to the portion the same as that of Embodiments 1 and 2, or considerable. In this embodiment, the glass electrode board 2 which constitutes an ink jet actuator is formed in line form, and this glass electrode board 2 is operated also as a substrate as a structure. That is, two or more head chips 100 which laminated and formed the passage substrate 1 and the cover glass 3 are arranged in line form, it joins to the glass electrode board 2 of line form, and a line head unit is formed.

[0067]The mount 53 shown in drawing 17 constitutes an ink passage like Embodiment 2, and it is replaced with this and it may be made to connect an ink supply pipe every head chip 100 like Embodiment 1.

[0068]By a face type, the composition of an ink jet head and a manufacturing method are the same as that of Embodiment 1, and in an edge type, since it is the same as that of Embodiment 2, they omit explanation here.

[0069]Embodiment 4.

(Embodiment of a printer) The appearance perspective view of the printer which is the embodiment of the invention 4 is shown in drawing 18. The outline composition of the main component part of the printer shown by drawing 18 is shown in drawing 19. The line ink jet head 151 shown in the printer 150 by Embodiments 1 thru/or 3 is carried.

[0070]The composition of the printer 150 is explained. The line ink jet head 151 arranged so that the printer 150 might include the record range, The feed roller 154 which makes it go via the recording position by this line ink jet head 151, and conveys the recording form 64, It has the conveyer style 155 containing the paper presser-foot roller 153 grade which presses down the recording form 64, and the ink feeding mechanism 157 which contains in the line ink jet head 151 the ink pipe 156 grade which supplies ink (mainly refer to drawing 19).

[0071]The ink tank with which the ink feeding mechanism 157 accommodates ink, and the ink circulating pump mechanism collected at the same time it sends ink to the line ink jet head 151, It consists of an ink tank and the ink pipe 156 piped between an ink circulating pump mechanism and the line ink jet beef fat

151, and these are accommodated in the seat part 158 (refer to drawing 18) of the ink feeding mechanism 157.

[0072]The printer 150 has composition containing a control circuit portion besides the above-mentioned composition. A control circuit portion carries out drive controlling of the line ink jet beef fat 151, the conveyer style 155, and the ink feeding mechanism 157, and it performs carrier transmission of data with a scanner and upper devices, such as a network.

[0073]In the printer 150 constituted as mentioned above, according to the bearer rate of the recording form 64, an ink drop is breathed out timely from the line ink jet head 155, and a character and a picture are printed to the recording form 64. That is, angle of rotation and speed of the feed roller 154 are detected, and corresponding to the detected bearer rate, a control section controls the driving timing of a head by the detecting mechanism which is not illustrated [which was attached to the conveyer style 155], and prints by making ink breathe out from a line ink jet head according to it. Thereby, clear printing can be performed at high speed.

[0074]Since printing is possible in operation of only sending the recording form 64 according to this embodiment, without moving an ink jet head in the record paper width direction, press speed can be raised extremely. High-speed printing can be realized without being able to simplify the composition of a device, and

manufacture becoming easy and complicating a drive circuit.

[0075]The manufacturing installation of the light filter which carries the ink jet head of above-mentioned Embodiments 1 thru/or 3 as Embodiment 5 of embodiment 5. this invention is explained.

[0076]When applying the ink jet head of above-mentioned Embodiments 1 thru/or 3 to the manufacturing installation of a light filter, In order to double the resolution of an ink jet head, and the picture element pitch of a light filter, an ink jet head is aslant arranged to a color filter substrate, and a picture element pitch is doubled and used, but the point is explained with reference to drawing 20.

[0077]Drawing 20 is the figure which looked at signs that the ink jet head was coloring the pixel of a light filter, from the top, and shows only the position of the nozzle row about the ink jet head. A situation when coloring the portion which should be colored red among the decided patterns is shown. The character of R, G, and B which are drawn on each pixel in drawing 20 shows that each pixel is colored red (R) green (G) blue (B).

[0078]The nozzle row 310 is formed in the ink jet head, ink is breathed out from here and an ink dot is formed on a substrate. The pixel (filter element) 311 of a light filter is a portion by which an ink dot is formed on a substrate.

[0079]In the example of drawing 20, from the interval P1 of the pixel of a light filter and the nozzle intervals P2 of an ink jet head not being in agreement. The

inside of a pixel is colored by forming an ink dot into the pixel 311, angle theta Leaning a head, coinciding the position of the pixel of the same color located in a line in the direction of Y every three, and the position of the ink breathed out from the nozzle in every five pieces, and moving an ink jet head relatively to the direction of X in a figure. A light filter is manufactured by performing this by red, green, and the ink jet head that carries out the regurgitation of each blue ink. For this reason, in the ink jet head for coloring the red pixel shown in this figure, it counts from the lower right, the 2nd, the 7th, and the 12th nozzle perform the regurgitation, and the regurgitation of other nozzles is not carried out.

[0080]In this example, the head of the general inkjet method of nozzle pitch 360dpi (70.5 micrometers) is used as an ink jet head. The thing of 100 micrometers of intervals between pixels is shown as a light filter.

[0081]In using a light filter as an optical element for a full color display, although one pixel is formed as one unit, the filter element of three colors of R, G, and B, The TORAIPU arrangement shown, for example in drawing 21 (a), the mosaic array shown in drawing 21 (b), the delta array shown in drawing 21 (c), etc. are known by the arrangement of this filter element. Stripe arrangement is a color scheme from which all the columns of a matrix become the same color. Three arbitrary filter elements of a mosaic array located in a line on the straight line in every direction are the color schemes used as three colors of R, G, and B. And a

delta array is a color scheme whose three adjoining arbitrary filter elements make arrangement of a filter element in a completely different class, and become three colors of R, G, and B.

[0082]Drawing 22 is a figure showing the outline of the manufacturing installation of the light filter which carries the ink jet head of an above-mentioned embodiment. The operation part 400 generates and outputs the drawing image (arrangement pattern of the pixel of a light filter) 401, and the nozzle switch signal 402. The drawing image (arrangement pattern of the pixel of a light filter) 401 is data in which the relative position relation of each ink dot which should be formed on the substrate 500 is shown. The nozzle switch signal 402 directs each point of the pixel of a light filter, and the change of a corresponding nozzle. If the concrete method of a change of a nozzle group is explained using drawing 20, supposing it will count from the right first and will use 2 and the 7 or 12th nozzle group, Further, although the next is easy to use [3, the 8 or 13th nozzle group, and] passing <a thing> on with 4 and the 9 or 14th nozzle group, it does not care about the next by other methods.

[0083]The change of a nozzle group shall be performed one by one, when the life of the nozzle used now comes. When the life of a nozzle is judged, for example based on the hour of use of one nozzle group and the hour of use of one nozzle group reaches predetermined time, it judges with the life having

come.

[0084]The drawing data generating device 403 generates the drawing data which is data of the absolute position on the substrate of each ink dot by performing correlation of each pixel on a substrate and a nozzle according to the nozzle switch signal 402. Under the present circumstances, if a nozzle is changed, in connection with it, change of the position of the nozzle before and behind a change will be calculated from the known data about a nozzle configuration, and only that part will change the position of the stage 408 at the time of each ink dot formation before and behind a nozzle change.

[0085]The driver 404 forms the ink dot as drawing data on the substrate 500 by driving the ink jet head 405 and the feed gear 406,407 according to drawing data. The ink jet head 405 is provided with the red head 405a which carries out the regurgitation of the red ink, the green head 405b which carries out the regurgitation of the green ink, and the blue head 405c which carries out the regurgitation of the blue ink. The feed gear 406,407 moves the position of the stage 408 in the direction of X, and the direction of Y according to the signal from the driver 404, respectively. The stage 408 holds the substrate 500 colored. The drawing pattern according to the drawing image 401 is generated on the substrate 500 by the above-mentioned composition.

[0086]Although the change of the physical relationship of the substrate which a

nozzle location shifts and is equivalent to quantity, and a plotting head accompanying a nozzle change is presumed from the known data about the nozzle configuration of a nozzle in this embodiment, With an image processing device etc., the physical relationship of the ink dot actually formed of each nozzle may be measured.

[0087]Drawing 23 is a figure showing typically the process in which a light filter is manufactured by the light filter manufacturing installation of above-mentioned Embodiment 4 at process order.

[0088](a) First, as shown in drawing 23 (a), with the resin material which does not have translucency in the surface of the mother board 512, see the septum 506 from the direction of arrow B, and form in a lattice-like pattern. The portion 507 of the lattice hole of a lattice-like pattern is the field in which the filter element 503 is formed, i.e., a filter-element field. The plane size at the time of seeing from the direction of arrow C of each filter-element field 507 formed of this septum 506 is formed in 30 micrometers x about 100 micrometers, for example.

[0089]The septum 506 has collectively a function which prevents a flow of the filter-element material supplied to the filter-element field 507, and a function of a black matrix. The septum 506 is formed with the arbitrary patterning techniques, for example, the photolithographic method, and is further heated and calcinated

with a heater if needed.

[0090](b) As shown in drawing 23 (b) after formation of the septum 506, each filter-element field 507 is filled up with the filter-element material 513 by supplying the drop 508 of filter-element material to each filter-element field 507. In drawing 23 (b), the numerals 513R show the filter-element material which has a color of R (red), and the numerals 513G show the filter-element material which has a color of G (green), and the numerals 513B show the filter-element material which has a color of B (blue).

[0091](c) If each filter-element field 507 is filled up with the filter-element material of the specified quantity, with a heater, the mother board 512 will be heated at about 70 **, and the solvent of filter-element material will be evaporated. By this evaporation, as shown in drawing 23 (c), the volume of the filter-element material 513 decreases and carries out flattening. When reduction in volume is intense, supply and heating of a drop of the drop of filter-element material are repeated and performed until thickness sufficient as a light filter is obtained. By the above processing, only the solid content of filter-element material remains and film-izes eventually, and, thereby, each color filter element 503 to wish is formed.

[0092](d) After the filter element 503 is formed of the above, in order to dry those filaments 503 thoroughly, perform heat-treatment of predetermined time at a

predetermined temperature. Then, for example, using proper techniques, such as a spin coat method, the roll coat method, the ripping method, or the ink jet method, as shown in drawing 23 (d), the protective film 504 is formed. This protective film 504 is formed for flattening of protection of filter-element 503 grade, and the surface of the light filter 501.

[0093]As mentioned above, according to this Embodiment 5, the light filter material of the additive primary colors of three colors can also be applied at a time on a process, and since the regurgitation of the light filter material is directly carried out to a filter element, it does not consume futilely. For this reason, the yield can be raised and a light filter manufacturing installation with sufficient cost performance can be obtained. since it is markedly alike and can create by low cost rather than the conventional method especially, even if it considers the cost of an ink jet head, a light filter with sufficient cost performance can be obtained. Light filter material is not made useless but it is good for environment.

[0094]In the embodiment 6. book embodiment 6, the procedure which creates an organic electroluminescence board by the organic electroluminescence board manufacturing installation using the ink jet head of the above-mentioned embodiment is explained. Since the organic electroluminescence board manufacturing installation in this case can apply most composition of the light filter manufacturing installation (drawing 22) explained by the above-mentioned

Embodiment 5, the graphic display of that composition shall be omitted.

[0095]Drawing 24 is a figure showing the main process of the manufacturing method of the EL device concerning this Embodiment 6, and the main section structures of an EL device acquired eventually. As EL device 601 is shown in drawing 24 (d), the picture element electrode 602 is formed on the transparent substrate 604, So that the bank 605 may see from the direction of arrow G, and may be formed in the shape of a lattice between each picture element electrode 602, the hole injection layer 620 may be formed into those lattice-like crevices, it may see from the direction of arrow G and it may become predetermined arrangement of stripe arrangement etc., R color luminous layer 603R, G color luminous layer 603G, and B color luminous layer 603B are formed into each lattice-like crevice, and the counterelectrode 613 is further formed on them.

[0096]When driving the above-mentioned picture element electrode 602 by a two terminal type active element called a TFD (thin-film diode) element etc., the above-mentioned counterelectrode 613 is seen from the direction of arrow G, and is formed in stripe shape. When driving the picture element electrode 602 by a three terminal type active element called TFT (thin film transistor) etc., the above-mentioned counterelectrode 613 is formed as a single field electrode.

[0097]The field across which each picture element electrode 602 and the electrode 613 for each sets face becomes one picture element pixel, and the

picture element pixel of R, G, and B3 color becomes one unit, and forms one pixel. By controlling the current which flows through each picture element pixel, what is wished of two or more picture element pixels is made to emit light selectively, and the full color image for which this wishes in the direction of arrow H can be displayed.

[0098]Above-mentioned EL device 601 is manufactured as follows, for example. (a) As shown in drawing 24 (a), form active devices, such as a TFD element and a TFT element, in the surface of the transparent substrate 604, and form the picture element electrode 602 further. As a formation method, the photolithographic method, a vacuum-like arrival method, SUPAKKU Ling's method, the metal fog method, etc. can be used, for example. As a material of a picture element electrode, the multiple oxide of ITO (Indium Tin Oxide), the tin oxide, indium oxide, and a zinc oxide, etc. can be used.

[0099]Next, the septum 605, i.e., a bank, is formed using the well-known patterning technique, for example, the photolithographic method, and between each transparent electrode 602 is filled with this bank 605. Thereby, the light leakage from between improvement in contrast, prevention of the mixed colors of a luminescent material, a pixel, and pixels, etc. can be prevented. Especially if it has endurance to the solvent of an EL material as a material of the bank 605, it will not be limited, but organic materials, such as that it can Teflon(registered

trademark)-ize by fluorocarbon gaseous plasma processing, for example, an acrylic resin, an epoxy resin, and photosensitive polyimide, are preferred.

[0100]Next, just before applying the ink for hole injection layers, continuation plasma treatment of oxygen gas and fluorocarbon gaseous plasma is performed to the substrate 604. Thereby, the polyimide surface is ******(ed), hydrophilization of the ITO surface is carried out and it can perform wettable control by the side of the substrate for patterning an ink jet drop minutely. As a device which generates plasma, it can use similarly with the device which generates plasma in a vacuum, or the device which generates plasma in the atmosphere.

[0101]Next, the ink for hole injection layers is breathed out from an ink jet head, and patterning spreading is performed on each picture element electrode 602. Then, the ink for luminous layers and the incompatible hole injection layer 620 are formed among the atmosphere by 20 ** (on a hot plate), and heat treatment for 10 minutes. Thickness is about 40 nm.

[0102](b) Next, as shown in drawing 24 (b), on the hole injection layer 620 in each filter-element field, use the ink jet technique and apply the ink for R luminous layers, and the ink for G luminous layers. Each ink for luminous layers can change thickness also here by changing the solids concentration and discharge quantity of an ink composition which carry out the regurgitation from

an ink jet head.

[0103]A solvent is removed on the conditions of a room temperature, 20 etc. minutes, etc. after spreading of the ink for luminous layers, and among a vacuum (1torr) (process P58), continuously, among a nitrogen atmosphere, it is made to conjugate by 150 ** and heat treatment of 4 hours, and R color luminous layer 603R and G color luminous layer 603G are formed. Thickness is about 50 nm. It is insoluble to a solvent in the luminous layer conjugated by heat treatment. Here, the xylene solution of PPV (poly para-phenylene vinylene) which doped rhodamine B is used for R color luminous layer 603R. The xylene solution of MEH-PPV is used for G color luminous layer 603G. The xylene solution of PPV which doped the coumarin is used for B color luminous layer 603B.

[0104]Before forming a luminous layer, continuation plasma treatment of oxygen gas and fluorocarbon gaseous plasma may be performed to the hole injection layer 620. Thereby, a fluorinated compound layer is formed on the hole injection layer 620, and when ionization potential becomes high, hole-injection efficiency can provide increase and an organic electroluminescence device with high luminous efficiency.

[0105](c) Next, as shown in drawing 24 (c), form B color luminous layer 603B in piles on R color luminous layer 603R in each picture element pixel, G color

luminous layer 603G, and the hole injection layer 620. Thereby, it not only forms the three primary colors of R, G, and B, but it can bury and carry out flattening of the level difference of R color luminous layer 603R and G color luminous layer 603G, and the bank 605. Thereby, an up-and-down inter-electrode short circuit can be prevented certainly. By adjusting the thickness of B color luminous layer 603B, in a laminated structure with R color luminous layer 603R and G color luminous layer 603G, B color luminous layer 603B acts as an electron injection transporting bed, and does not emit light in B color.

[0106]As a formation method of the above B color luminous layers 603B, the general spin coat method as wet process can also be adopted, for example, or the method of forming R color luminous layer 603R and G color luminous layer 603G and the same ink jet method can also be adopted.

[0107](d) As shown in drawing 24 (d) after that, manufacture target EL device 601 by forming the counterelectrode 613. The counterelectrode 613 can be formed by being made from Mg, Ag, aluminum, Li, etc. using the forming-membranes methods, such as vacuum deposition and a sputtering technique, for example, when it is a field electrode. When the counterelectrode 613 is a stripe like electrode, the formed electrode layer can be formed using the patterning technique of the photolithographic method etc.

[0108]In the manufacturing method of the EL device explained above, As the

control method of an ink jet head, to hole injection layer [in each picture element pixel in drawing 24] 620 and R, G, and B each color luminous layers 603R, 603G, and 603B. It does not form by the one horizontal scanning X of an ink jet head, but the hole injection layer and/or each color luminous layer in one picture element pixel may be formed by two or more nozzles, and it may be made to form predetermined thickness n times, for example, by receiving ink discharge in piles 4 times. Even when variation exists in an amount of ink discharged among two or more nozzles temporarily by doing in this way, variation can be prevented from arising in thickness among two or more picture element pixels, and, so, the emission distribution characteristic of the light-emitting surface of an EL device can be superficially made uniform. This as used in EL device 601 of drawing 24 (d) means that a clear colored presentation without an irregular color is obtained.

[0109]As mentioned above, since each painting matter pixel of R, G, and B is formed by the ink discharge using an ink jet head according to the manufacturing method of the EL device of this embodiment, there is also no necessity of passing through a complicated process like the method of using the photolithographic method, and material is not wasted.

[0110]Although the method of for example making a luminous layer vapor-deposit a metal color etc. is taken by the former as a method of forming a luminous layer etc. in an EL device, if an organic electroluminescence board is

manufactured with an inkjet method, spreading of a polymers organic compound and patterning used as electroluminescence devices can carry out by once. What is necessary is just not to make useless the organic compound used as electroluminescence devices, but to carry out the regurgitation of the necessary minimum quantity, since the regurgitation is directly carried out to the target position.

[0111]Since the organic compound and solution which are used for R, G, and B each color luminous layers 603R, 603G, and 603B have various kinds of things, it may not be what was shown especially in the above. Material which colors in neutral colors may be used. However, since weight, viscosity, etc. change with each material, according to the material which carries out the regurgitation, it is necessary to adjust ink weight and ink speed.

[0112]

[Effect of the Invention]According to this invention, the substrate with which the energy generation element which gives regurgitation energy to a nozzle plate or the ink of the regurgitation interior of a room was formed is formed in line form as mentioned above, Since two or more head chips are arranged in line form and installed in the nozzle plate or substrate of this line form, the nozzle plate or substrate of line form is the component part of the actuator of an ink jet head, and it has the function of the substrate as a structure. Therefore, the substrate

as a structure is not needed separately, but there are few part mark, structure is simple, and the miniaturization of a head and a weight saving are made.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is an explanatory view of the entire configuration of Embodiment 1 of this invention.

[Drawing 2]It is an exploded perspective view of the ink jet head concerning Embodiment 1 of this invention.

[Drawing 3]It is a section side view of the ink jet head of drawing 1.

[Drawing 4]It is an A-A line view figure of drawing 3.

[Drawing 5]It is an explanatory view of the manufacturing method of the head chip board (the 1st substrate) which constitutes the ink jet head of drawing 1.

[Drawing 6]It is an explanatory view of the manufacturing method of the head chip board (the 2nd substrate) which constitutes the ink jet head of drawing 1.

[Drawing 7]It is an explanatory view of the manufacturing method of the head chip board (the 3rd substrate) which constitutes the ink jet head of drawing 1.

[Drawing 8]It is an explanatory view of the assembly process of the ink jet head

of drawing 1.

[Drawing 9]It is an explanatory view of the entire configuration of Embodiment 2 of this invention.

[Drawing 10]It is an exploded perspective view of the ink jet head concerning Embodiment 2 of this invention.

[Drawing 11]It is a section side view of the ink jet head of drawing 9.

[Drawing 12]It is an explanatory view of the manufacturing method of the head chip board (passage substrate) which constitutes the ink jet head of drawing 9.

[Drawing 13]It is an explanatory view of the manufacturing method of the head chip board (glass electrode board) which constitutes the ink jet head of drawing 9.

[Drawing 14]It is an explanatory view of the manufacturing method of the head chip board (cover glass) which constitutes the ink jet head of drawing 9.

[Drawing 15]It is a partial flat section of the ink jet head of drawing 9.

[Drawing 16]It is an explanatory view of the assembly process of the ink jet head of drawing 9.

[Drawing 17]It is an explanatory view of the entire configuration of Embodiment 3 of this invention.

[Drawing 18]It is an appearance perspective view of the printer which is Embodiment 4 of this invention.

[Drawing 19]It is an explanatory view of the composition of the main component part of the printer shown in drawing 19.

[Drawing 20]It is a figure showing the state where signs that the ink jet head was coloring the pixel of a light filter were seen from the top.

[Drawing 21]It is an explanatory view showing the example of arrangement of the filter element of a light filter.

[Drawing 22]It is a figure showing the outline of the manufacturing installation of the light filter concerning Embodiment 4 of this invention.

[Drawing 23]It is a figure showing typically the process in which a light filter is manufactured by the light filter manufacturing installation of drawing 22 at process order.

[Drawing 24]It is a figure showing the main process of the manufacturing method of the EL device concerning Embodiment 5 of this invention, and the main section structures of an EL device acquired eventually.

[Description of Notations]

1 The 1st substrate, a passage substrate

2 The 2nd substrate, a glass electrode board

3 The 3rd substrate, a cover glass

4 Nozzle hole

5 Diaphragm

6 Regurgitation room

8 Ink reservoir

21 Electrode

41 Nozzle plate

100 Head chip

150 Printer